

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Presently Amended) A computer system that employs a plurality of threads of execution to perform a parallel-execution operation in which the threads identify tasks dynamically and in which the computer system comprises:
 4. A) a mechanism that associates a separate status-word field with each of the threads; and
 6. B) a mechanism that operates the threads in a manner that **each thread**:
 8. i) **each thread** executes a task-finding routine to find tasks previously identified dynamically and performs tasks thereby found, with its associated status-word field containing a value indicating it is active, until the task-finding routine finds no more tasks;
 12. ii) when the task-finding routine executed in step (i) finds no more tasks, that thread sets the contents of its associated status-word field to a value indicating it is inactive;
 15. iii) after completing step (ii) and while the status-word field associated with any other thread contains a value indicating that the other thread is active, that thread searches continues to search for a task using the task-finding routine, and, if it finds one, sets its associated status-word field contents to a value indicating that it is active before attempting to execute a found task; and
 21. iv) if during step (iii) when none of the status-word fields associated with other threads contains a value indicating that an associated thread is active and no task has been found, that thread terminates its performance of the parallel-execution operation.

- 1 2. (Original) A computer system as defined in claim 1 wherein the parallel-execution
2 operation is a garbage-collection operation.
- 1 3. (Currently Amended) A computer system as defined in claim 1 wherein:
2 A) each thread has associated with it a respective work queue in
3 which it places task identifiers of tasks that thread identifies dynamically;
4 B) the task-finding routine executed by ~~an executing~~ that thread
5 includes performing an initial search for a task identifiers in the work queue
6 associated with ~~the executing~~ that thread and, if that work queue contains no
7 task identifiers that ~~the executing~~ thread can claim, thereafter performing a
8 further search for a task identifier in at least one other task-storage location.
- 1 4. (Original) A computer system as defined in claim 3 wherein the parallel-execution
2 operation is a garbage-collection operation.
- 1 5. (Original) A computer system as defined in claim 3 wherein the at least one other
2 task-storage location includes at least one work queue associated with a thread
3 other than the executing thread.
- 1 6. (Original) A computer system as defined in claim 5 wherein:
2 A) there is a size limit associated with each work queue;
3 B) when a given thread dynamically identifies a given task that would
4 cause the number of task entries in the work queue associated with the given
5 thread to exceed the size limit if a task identifier that identifies it were placed in
6 that work queue, the given thread instead places that task identifier in an
7 overflow list instead of in that work queue; and
8 C) the at least one other task-storage location includes at least one
9 such over flow list.

- 1 7. (Original) A computer system as defined in claim 5 wherein the task-finding
2 routine includes selecting in a random manner the at least one work queue
3 associated with a thread other than the executing thread.
- 1 8. (Original) A computer system as defined in claim 5 wherein the further search
2 includes repeatedly searching a work queue associated with a thread other than
3 the executing thread until the executing thread thereby finds a task or has
4 performed a number of repetitions equal to a repetition limit greater than one.
- 1 9. (Original) A computer system as defined in claim 8 wherein the task-finding
2 routine includes selecting in a random manner the at least one work queue
3 associated with a thread other than the executing thread.
- 1 10. (Original) A computer system as defined in claim 3 wherein:
2 A) there is a size limit associated with each work queue;
3 B) when a given thread dynamically identifies a given task that would
4 cause the number of task entries in the work queue associated with the given
5 thread to exceed the size limit if a task identifier that identifies it were placed in
6 that work queue, the given thread instead places that task identifier in an
7 overflow list instead of in that work queue; and
8 C) the at least one other task-storage location includes at least one
9 such over flow list.
- 1 11. (Presently Amended) A computer system as defined in claim 1 wherein the
2 contents of all of the status-word fields, when taken together, form a status word
3 that fits fit in a memory location accessible in a single machine instruction.
- 1 12. (Original) A computer system as defined in claim 11 wherein the parallel-
2 execution operation is a garbage-collection operation.

- 1 13. (Original) A computer system as defined in claim 11 wherein each status-word
2 field is a single-bit field.
- 1 14. (Previously Presented) A computer system as defined in claim 13 wherein each
2 single-bit field contains a logic one to indicate that the associated thread is active
3 and contains a logic zero to indicate that the associated thread is inactive.
- 1 15. (Presently Amended) For employing a plurality of threads of execution to perform
2 a parallel-execution operation in which the threads identify tasks dynamically, a
3 method comprising:
4 A) associating a separate status-word field with each of the threads;
5 and
6 B) operating the threads in a manner that each thread:
7 i) each thread executes a task-finding routine to find tasks
8 previously identified dynamically and performs tasks thereby found, with
9 its associated status-word field containing a value indicating it is active,
10 until the task-finding routine finds no more tasks;
11 ii) when the task-finding routine executed in step (i) finds no
12 more tasks, that thread sets the contents of its associated status-word
13 field to a value indicating it is inactive;
14 iii) after completing step (ii) and while the status-word field
15 associated with any other thread contains a value indicating that the other
16 thread is active, that thread searches continues to search for a task using
17 the task-finding routine, and, if it finds one, sets its associated status-word
18 field contents to a value indicating that it is active before attempting to
19 execute a found task; and
20 iv) if during step (iii) when none of the status-word fields
21 associated with other threads contains a value indicating that an
22 associated thread is active and no task has been found, that thread
23 terminates its performance of the parallel-execution operation.

1 16. (Original) A method as defined in claim 15 wherein the parallel-execution
2 operation is a garbage-collection operation.

1 17. (Currently Amended) A method as defined in claim 15 wherein:

- A) each thread has associated with it a respective work queue in which it places task identifiers of tasks that thread identifies dynamically;
- B) the task-finding routine executed by ~~an executing~~ that thread includes performing an initial search for a task identifiers in the work queue associated with ~~the executing~~ that thread and, if that work queue contains no task identifiers that ~~the executing~~ thread can claim, thereafter performing a further search for a task identifier in at least one other task-storage location.

1 18. (Original) A method as defined in claim 17 wherein the parallel-execution
2 operation is a garbage-collection operation.

1 19. (Original) A method as defined in claim 17 wherein the at least one other task-
2 storage location includes at least one work queue associated with a thread other
3 than the executing thread.

1 20. (Original) A method as defined in claim 19 wherein:

- A) there is a size limit associated with each work queue;
- B) when a given thread dynamically identifies a given task that would cause the number of task entries in the work queue associated with the given thread to exceed the size limit if a task identifier that identifies it were placed in that work queue, the given thread instead places that task identifier in an overflow list instead of in that work queue; and

C) the at least one other task-storage location includes at least one such over-flow list.

- 1 21. (Original) A method as defined in claim 19 wherein the task-finding routine
2 includes selecting in a random manner the at least one work queue associated
3 with a thread other than the executing thread.
- 1 22. (Original) A method as defined in claim 19 wherein the further search includes
2 repeatedly searching a work queue associated with a thread other than the
3 executing thread until the executing thread thereby finds a task or has performed
4 a number of repetitions equal to a repetition limit greater than one.
- 1 23. (Original) A method as defined in claim 22 wherein the task-finding routine
2 includes selecting in a random manner the at least one work queue associated
3 with a thread other than the executing thread.
- 1 24. (Original) A method as defined in claim 17 wherein:
2 A) there is a size limit associated with each work queue;
3 B) when a given thread dynamically identifies a given task that would
4 cause the number of task entries in the work queue associated with the given
5 thread to exceed the size limit if a task identifier that identifies it were placed in
6 that work queue, the given thread instead places that task identifier in an
7 overflow list instead of in that work queue; and
8 C) the at least one other task-storage location includes at least one
9 such over-flow list.
- 1 25. (Presently Amended) A method as defined in claim 15 wherein the contents of all
2 of the status-word fields, when taken together, form a status-word that fits fit in a
3 memory location accessible in a single machine instruction.
- 1 26. (Original) A method as defined in claim 25 wherein the parallel-execution
2 operation is a garbage-collection operation.

- 1 27. (Original) A method as defined in claim 25 wherein each status-word field is a
2 single-bit field.

1 28. (Previously Presented) A method as defined in claim 27 wherein each single-bit
2 field contains a logic one to indicate that the associated thread is active and
3 contains a logic zero to indicate that the associated thread is inactive.

1 29. (Presently Amended) A storage medium containing instructions readable by a
2 computer system to configure the computer system to employ a plurality of
3 threads of execution to perform a parallel-execution operation in which the
4 threads identify tasks dynamically and in which the computer system comprises:
5 A) a mechanism that associates a separate status-word field with each
6 of the threads; and
7 B) a mechanism that operates the threads in a manner that each
8 thread:
9 i) each thread executes a task-finding routine to find tasks
10 previously identified dynamically and performs tasks thereby found, with
11 its associated status-word field containing a value indicating it is active,
12 until the task-finding routine finds no more tasks;
13 ii) when the task-finding routine executed in step (i) finds no
14 more tasks, that thread sets the contents of its associated status-word
15 field to a value indicating it is inactive;
16 iii) after completing step (ii) and while the status-word field
17 associated with any other thread contains a value indicating that the other
18 thread is active, that thread searches continues to search for a task using
19 the task0finding routine, and, if it finds one, sets its associated status-word
20 field contents to a value indicating that it is active before attempting to
21 execute a found task; and
22 iv) if none of the status-word fields associated with other
23 threads contains a value indicating that an associated thread is active,
24 terminates its performance of the parallel-execution operation.

- 1 30. (Original) A storage medium as defined in claim 29 wherein the parallel-
2 execution operation is a garbage-collection operation.
- 1 31. (Currently Amended) A storage medium as defined in claim 29 wherein:
2 A) each thread has associated with it a respective work queue in
3 which it places task identifiers of tasks that thread identifies dynamically;
4 B) the task-finding routine executed by ~~an executing~~that thread
5 includes performing an initial search for a task identifiers in the work queue
6 associated with ~~the executing~~ that thread and, if that work queue contains no
7 task identifiers that ~~the executing~~ thread can claim, thereafter performing a
8 further search for a task identifier in at least one other task-storage location.
- 1 32. (Original) A storage medium as defined in claim 31 wherein the parallel-
2 execution operation is a garbage-collection operation.
- 1 33. (Original) A storage medium as defined in claim 31 wherein the at least one other
2 task-storage location includes at least one work queue associated with a thread
3 other than the executing thread.
- 1 34. (Original) A storage medium as defined in claim 33 wherein:
2 A) there is a size limit associated with each work queue;
3 B) when a given thread dynamically identifies a given task that would
4 cause the number of task entries in the work queue associated with the given
5 thread to exceed the size limit if a task identifier that identifies it were placed in
6 that work queue, the given thread instead places that task identifier in an
7 overflow list instead of in that work queue; and
8 C) the at least one other task-storage location includes at least one
9 such overflow list.

- 1 35. (Original) A storage medium as defined in claim 33 wherein the task-finding
2 routine includes selecting in a random manner the at least one work queue
3 associated with a thread other than the executing thread.
- 1 36. (Original) A storage medium as defined in claim 33 wherein the further search
2 includes repeatedly searching a work queue associated with a thread other than
3 the executing thread until the executing thread thereby finds a task or has
4 performed a number of repetitions equal to a repetition limit greater than one.
- 1 37. (Original) A storage medium as defined in claim 36 wherein the task-finding
2 routine includes selecting in a random manner the at least one work queue
3 associated with a thread other than the executing thread.
- 1 38. (Original) A storage medium as defined in claim 31 wherein:
2 A) there is a size limit associated with each work queue;
3 B) when a given thread dynamically identifies a given task that would
4 cause the number of task entries in the work queue associated with the given
5 thread to exceed the size limit if a task identifier that identifies it were placed in
6 that work queue, the given thread instead places that task identifier in an
7 overflow list instead of in that work queue; and
8 C) the at least one other task-storage location includes at least one
9 such over flow list.
- 1 39. (Presently Amended) A storage medium as defined in claim 29 wherein the
2 contents of all of the status-word fields, ~~when taken together, form a status word~~
3 ~~that fits fit~~ in a memory location accessible in a single machine instruction.
- 1 40. (Original) A storage medium as defined in claim 39 wherein the parallel-
2 execution operation is a garbage-collection operation.

- 1 41. (Original) A storage medium as defined in claim 39 wherein each status-word
2 field is a single-bit field.
- 1 42. (Previously Presented) A storage medium as defined in claim 41 wherein each
2 single-bit field contains a logic one to indicate that the associated thread is active
3 and contains a logic zero to indicate that the associated thread is inactive.
- 1 43. (Presently Amended) A computer signal representing a sequence of instructions
2 that, when executed by a computer system, configures the computer system to
3 employ a plurality of threads of execution to perform a parallel-execution
4 operation in which the threads identify tasks dynamically and in which the
5 computer system comprises:
6 A) a mechanism that associates a separate status-word field with each
7 of the threads; and
8 B) a mechanism that operates the threads in a manner that each
9 thread:
10 i) each thread executes a task-finding routine to find tasks
11 previously identified dynamically and performs tasks thereby found, with
12 its associated status-word field containing a value indicating it is active,
13 until the task-finding routine finds no more tasks;
14 ii) when the task-finding routine executed in step (i) finds no
15 more tasks, that thread sets the contents of its associated status-word
16 field to a value indicating it is inactive;
17 iii) after completing step (ii) and while the status-word field
18 associated with any other thread contains a value indicating that the
19 associated thread is active, that thread searches continues to search for a
20 task using the task-finding routine, and, if it finds one, sets its associated
21 status-word field contents to a value indicating that it is active before
22 attempting to execute a found task; and
23 iv) if during step (iii) when none of the status-word fields
24 contains a value indicating that an associated thread is active and no task

25 has been found, that thread terminates its performance of the parallel-
26 execution operation.

1 44. (Original) A computer signal as defined in claim 43 wherein the parallel-execution
2 operation is a garbage-collection operation.

1 45. (Currently Amended) A computer signal as defined in claim 43 wherein:
2 A) each thread has associated with it a respective work queue in
3 which it places task identifiers of tasks that thread identifies dynamically;
4 B) the task-finding routine executed by ~~an executing~~ that thread
5 includes performing an initial search for a task identifiers in the work queue
6 associated with ~~the executing~~ that thread and, if that work queue contains no
7 task identifiers that ~~the executing~~ thread can claim, thereafter performing a
8 further search for a task identifier in at least one other task-storage location.

1 46. (Original) A computer signal as defined in claim 45 wherein the parallel-execution
2 operation is a garbage-collection operation.

1 47. (Original) A computer signal as defined in claim 45 wherein the at least one other
2 task-storage location includes at least one work queue associated with a thread
3 other than the executing thread.

1 48. (Original) A computer signal as defined in claim 47 wherein:
2 A) there is a size limit associated with each work queue;
3 B) when a given thread dynamically identifies a given task that would
4 cause the number of task entries in the work queue associated with the given
5 thread to exceed the size limit if a task identifier that identities it were placed in
6 that work queue, the given thread instead places that task identifier in an
7 overflow list instead of in that work queue; and
8 C) the at least one other task-storage location includes at least one
9 such over flow list.

- 1 49. (Original) A computer signal as defined in claim 47 wherein the task-finding
2 routine includes selecting in a random manner the at least one work queue
3 associated with a thread other than the executing thread.
- 1 50. (Original) A computer signal as defined in claim 47 wherein the further search
2 includes repeatedly searching a work queue associated with a thread other than
3 the executing thread until the executing thread thereby finds a task or has
4 performed a number of repetitions equal to a repetition limit greater than one.
- 1 51. (Original) A computer signal as defined in claim 50 wherein the task-finding
2 routine includes selecting in a random manner the at least one work queue
3 associated with a thread other than the executing thread.
- 1 52. (Original) A computer signal as defined in claim 45 wherein:
2 A) there is a size limit associated with each work queue;
3 B) when a given thread dynamically identifies a given task that would
4 cause the number of task entries in the word queue associated with the given
5 thread to exceed the size limit if a task identifier that identifies it were placed in
6 that work queue, the given thread instead places that task identifier in an
7 overflow list instead of in that work queue; and
8 C) the at least one other task-storage location includes at least one
9 such over flow list.
- 1 53. (Presently Amended) A computer signal as defined in claim 43 wherein the
2 contents of all of the status-word fields, taken together, form a status word that
3 fits fit in a memory location accessible in a single machine instruction.
- 1 54. (Original) A computer signal as defined in claim 53 wherein the parallel-execution
2 operation is a garbage-collection operation.

- 1 55. (Original) A computer signal as defined in claim 53 wherein each status-word
2 field is a single-bit field.
- 1 56. (Previously Presented) A computer signal as defined in claim 55 wherein each
2 single-bit field contains a logic one to indicate that the associated thread is active
3 and contains a logic zero to indicate that the associated thread is inactive.
57. (Presently Amended) A computer system that employs a plurality of threads of execution to perform a parallel-execution operation in which the threads identify tasks dynamically, the computer system including:
- A) means for associating a separate status-word field with each of the threads; and
 - B) means for operating the threads in a manner that each thread:
 - i) each thread executes a task-finding routine to find tasks previously identified dynamically and performs tasks thereby found, with its associated status-word field containing a value indicating it is active, until the task-finding routine finds no more tasks;
 - ii) when the task-finding routine executed in step (i) finds no more tasks, that thread sets the contents of its associated status-word field to a value indicating it is inactive;
 - iii) after completing step (ii) and while the status-word field associated with any other thread contains a value indicating that the other thread is active, that thread searches continues to search for a task using the task-finding routine, and, if it finds one, sets the status-word field contents to the activity-indicating a value indicating that it is active before attempting to execute a found task; and
 - iv) if during step (iii) when none of the status-word fields associated with other threads contains a value indicating that an associated thread is active and no task has been found, that thread terminates its performance of the parallel-execution operation.